MacPEAK Systems
1201 Spyglass
Austin, Texas 78746
512/327-3211

USER MANUAL

Orion SE 20/25 Installation and User's Manual

MacPEAK
SYSTEMS

Table of Contents

Table of Figures 4

Before you get started **6**

Purpose of this manual 6

Who should install your Orion SE? 6

What to read next... 7

About the Orion SE **7**

Notes about using your Orion SE with the Macintosh SE 7

Why the Orion SE is more software compatible than the Macintosh II 10

Sound programs and the Orion SE 11

Starting the Installation of the Orion SE **12**

Proper handling of your Orion SE 12

What you should have received with your Orion SE 14

Upgrade options for the Orion SE 16

Preparing the Macintosh SE **18**

Table of Contents (cont.)

Preparing the Orion SE 19

Memory configurations for the Orion SE 20

Removing two SIMMs from the SE 22

Installing the SIMMs from the SE main logic board onto the Orion SE 22

Removing the ROMs from the SE main logic board 26

Installing the ROMs onto the Orion SE 29

Setting the jumpers on the Orion SE 30

Placing the Orion SE board on the SE main logic board 32

Installing the Orion SE 33

Check that everything is ready 33

Position front of Mac SE/Orion SE board into bottom front of Mac SE chassis 33

Connect speaker cable 35

Swing boards into the chassis 35

Reconnect internal cables 38

Power-up test 38

Completing the installation 39

Table of Contents (cont.)

Using your Orion SE 41

The Orion SE control software 41

Installing the Orion SE control software 41

Using the control software 42

Memory speeds available based on processor speed 43

Troubleshooting 49

Appendix A : Using 1Mb SIMMs on the SE main logic board 52

Table of Figures

Figure 1 : Discharging static electricity 13

Figure 2 : The Orion SE logic board 13

Figure 3 : The processor, ROM, and expansion sockets on the Orion SE 14

Figure 4 : The contents of your Orion SE diskette 13

Figure 5 : Removing the SIMMs from the SE main logic board 21

Figure 6 : Installing the 256K SIMMs on a 1Mb Orion SE 23

Figure 7 : Installing the 256K SIMMs on a 2Mb Orion SE 24

Figure 8 : Installing the 1Mb SIMMs on a 4Mb Orion SE 24

Figure 9 : Installing the 256K and 1Mb SIMMs on a 5Mb Orion SE 25

Figure 10 : Installing the 1Mb SIMMs on an 8Mb Orion SE 25

Figure 11 : Location of the ROMs on the SE main logic board 27

Figure 12 : Removing the ROMs from the SE main logic board 28

Figure 13 : The direction marking on the ROMs 28

Figure 14 : Location of the ROM sockets on the Orion SE 29

Table of Figures (cont.)

Figure 15 : Detail of the J1 jumper 31

Figure 16 : Detail of the J2 jumper 31

Figure 17 : Positioning the Mac SE/ Orion SE board into the Mac SE chassis 34

Figure 18 : Detail view of the tabs in the bottom front of the Mac SE chassis 34

Figure 19 : Positioning the boards/chassis when connecting the sound cable 36

Figure 20 : Location of the sound connector on the SE main logic board 36

Figure 21 : Swinging the boards into the chassis 37

Figure 22 : Detail of the metal tabs on the SE main logic board 37

Figure 23 : Detail of inserting the SE main logic tabs into the SE chassis 38

Before you get started...

The purpose of this manual is to provide all the information needed to install and use the Orion™ SE 20Mhz and 25Mhz cards. For the purposes of installation and usage, the Orion SE 20 and the Orion SE 25 are virtually identical except for their speed capabilities. MacPEAK also provides an entry level product known as the Orion One. Through the rest of this manual, the Orion SE 20 and Orion SE 25 will be referred to as the Orion SE.

It is strongly suggested that this manual be read through once before actually starting the installation process. You should find that once the entire procedure is understood the individual steps needed for installing and using the board will make complete sense. It is also important to note here that by sending in your registration card, you will automatically be updated of any changes or available upgrades in the future.

Who should install your Orion SE?

The Orion SE is not a user-installable device. Due to the hazardous nature of the internals of the Macintosh SE, MacPEAK strongly recommends that an Apple authorized service center handle the installation of your Orion SE. This manual contains the information in a step by step form for installing the Orion SE but this information is intended to be used by a trained technician who has not previously worked with an Orion SE . MacPEAK does not include the special tools necessary for opening the Macintosh SE case. If you have never opened a Macintosh case or worked inside a Macintosh computer, installing your Orion SE is not a good place to start.

What to read next...

If your intention is to first install the Orion SE and read about it later, skip ahead to the section "Starting the Installation of the Orion SE " on page 12. If you would like some background information about what the Orion SE is and how it works, continue on with the next section. If your Orion SE has already been installed and you wish to read about the background information on the Orion SE later, skip ahead to the section "Using your Orion SE " on page 41.

About your Orion SE

Notes about using your Orion SE with the Macintosh SE

Your Orion SE is an add-on card that gives your Macintosh SE computing power equal or greater than the Macintosh II or IIx. Not only is the speed of the SE increased by four to eight times that of a normal SE, but eight SIMM sockets for memory are provided compared with only four with a normal SE. Your Orion SE is a completely natural addition to your Macintosh SE since it plugs into the 96 pin connector Apple has provided for optional cards.

Your Orion SE is actually a full computer in its own right. Equipped with a MC68020 processor (the same as used in the Macintosh II), sockets for both the MC68881 floating point co-processor and the MC68851 memory management co-processor and eight SIMM memory sockets, your Orion SE effectively "takes over" the computing of the Macintosh SE it is installed in. All computational activity is carried out on your Orion SE , and the Mac SE's original computer board is used to handle other areas such as the internal SE screen display, sound, Appletalk, SCSI drives, and any other external device that may be connected to the SE.

It is reported that many people would buy a Macintosh II instead of a Macintosh SE if the costs were the same. However, most people find that the Macintosh SE serves their needs well, and at last report was the best selling Macintosh model, followed by the Macintosh Plus. Still, many wish for the computational speed of the Macintosh II in order to greatly increase their productivity.

The Macintosh II does have costs beside the dollar price. In addition to not being a portable machine there still are a reasonable number of programs (as of '88) which simply have problems running on the Macintosh II, even though they run fine on the SE. This is usually due to the fact that the software is not able to handle one of the following problems.

1) The Macintosh II uses a 16mhz 68020.

When the Mac II first appeared, this was a problem for programs like MacWrite™ and others that "broke the rules" of how a program should handle advanced processors like the 68020. The 68020 is almost entirely compatible with software written for the 68000, but there are areas that differ. Any software with this problem will be crippled on any '020 based Macintosh, be it the Mac II or any '020 based accelerator for the Mac Plus or Mac SE. In virtually every case, software developers have released new versions of software to eliminate these problems.

2) The Macintosh II has a large number of new or changed software routines programmed in its ROM chips.

The Macintosh ROM routines are the foundation for virtually all software written for the Macintosh. For example, when a window needs to be drawn on the screen, the program currently running gathers all the information needed about the window and then requests that the instructions in the ROM carry out the actions needed to do the actual drawing. For a reasonable amount of time before the Macintosh II was released, Apple sent out information to software developers letting them know what programming techniques would and would not work on future (ie: Mac II) machines. Most software was written with these rules in mind, but as most Macintosh II owner know, there is a measurable percentage of software that still has problems on the Macintosh II. This is also being addressed by most software developers who obviously wish their software to run on all versions of Macintosh, but it is a much more common and in some cases more complicated problem than the 68020 compatiblity problem.

The Macintosh SE also was equipped with new ROMs but the changes made caused significantly fewer problems than on the Macintosh II.

3) The Macintosh II does not provide for the use of the "alternate screen buffer" or the "alternate sound buffer". The Macintosh SE also does not provide the "alternate sound buffer".

People who own some game programs like the original "Dark Castle™" discovered that they too did not work at all on the Macintosh II. Among the things that Apple told software developers not to depend on was the memory spaces in the Macintosh known as the "alternate" screen and sound buffers. These simply were locations in memory that duplicated the memory used to display graphics on the screen and create sounds. These areas are used primarily by games in order to allow very fast animation effects on the screen. While the program was letting something happen on the main screen, items could be drawn on the alternate screen, then the program would quickly "switch" screens and show the newly drawn area, instead of actually drawing it out on the normal screen. Then, the program would draw into the original screen and again "switch". Game designers were aware this might not always work on future machines, but for many games there were few alternatives available that would allow the same level of smooth screen action. Again, many currently shipping game programs are releasing new versions that find ways around this problem but this usually involves a re-write of the program.

Why your Orion SE is more software compatible than the Macintosh II.

The three problems above account for the vast majority of the incompatiblity problems today's software encounters. Here is how your Orion SE handles these problems in order to provide the maximum compatibilty possible:

1) Your Orion SE can not avoid the problems caused by software that does not function properly on the 68020. However, since this software will fail on any Macintosh using the '020 (including the Mac II and all accelerators using the '020 chip) software developers have quickly released new versions of older software that fixes this problem. There were only a handful of programs that ran into this incompatibility, none of which are currently commercially shipping.

2) Your Orion SE uses the exact same ROMs that the normal SE does, and therefore avoids all problems that are caused by differences of the Macintosh II ROMs. The combination of Mac II performance and the lack of software problems caused by changes in the Mac II ROMs allows Orion SE owners to get full use of all their applications software.

3) Your Orion SE does provide the alternate screen and sound buffers in hardware on your Orion SE and therefore avoids problems with many games that the Macintosh II can not run. As far as game programs are concerned, this capability means the difference between working correctly or not operating at all.

Sound Programs and your Orion SE

Your Orion SE will occasionally run into problems with older sound programs. This is mostly due to the difference in clock speed of your Orion SE and the normal SE. Sound software can be very timing dependent and on high performance sound software the capability to work flawlessly at different clock speeds was not practical for all developers. However, due to the Macintosh II most sound programs are being upgraded to handle such clock speeds. If you encounter problems with a sound program, contact the software developer to see if the software also has difficulities on the Macintosh II. If it does, chances are very strong that the developer is working on a version that will work properly at higher speeds.

Important Note: *The control software does allow for the speed of the Orion SE to be "turned off" so that your Macintosh will perform as the same level as a normal Macintosh SE. Please refer to the section Using your Orion SE for a description on how to turn off the effects of your Orion SE. Virtually all sound programs will work correctly when this option is selected. This option can be used without restarting the machine.*

You will find that many sound programs that sound "scratchy" on your Orion SE will not function at all on the Macintosh II. One example is the original version of "Talking Moose", a favorite of Mac users everywhere. "Moose" will still work on your Orion SE , albeit with a sore throat. Unfortunately,the original version of "Moose" does not work on the Macintosh II.

Starting the Installation of the Orion SE

Proper handling of your Orion SE

Warning about static electricity: Your Orion SE should only be taken out of its static-proof bag at a location that is free of static electricity. Static electricty is the electricty that gives you a shock if you rub your feet on a carpet and then touch a doorknob. That shock and spark is capable of damaging your Orion SE. It is reported that most electronics can be damaged by static electricity that would never be felt by a person so be especially careful on carpeted floors.

If at all possible, the Orion SE should be handled in a non-carpeted area. Also, before handling your Orion SE , you should discharge any static electricity you may be carrying by touching grounded metal. One of the best ways you can do this is by removing the small plastic panel from the rear of your Macintosh SE. Behind the panel you will see a metal bracket. With the SE plugged in, **but with the power turned off** touch the metal bracket of the SE. (See figure 1 for detail). Even if you had been carrying static electricty you probably would not feel a spark, but nevertheless may have been carrying enough of a charge to cause damage to a computer board. If you leave the area and return, or move around quite a bit while installing your Orion SE (especially if you are working on carpet) re-touch the metal bracket before continuing the installation.

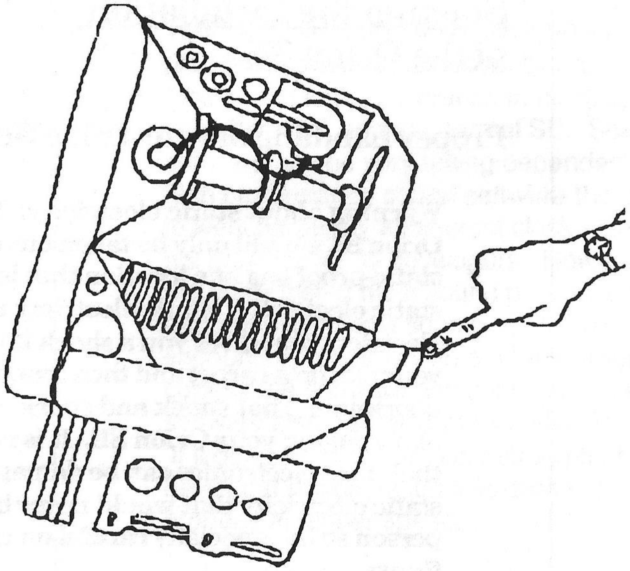


Figure 1 : Discharging Static Electricity

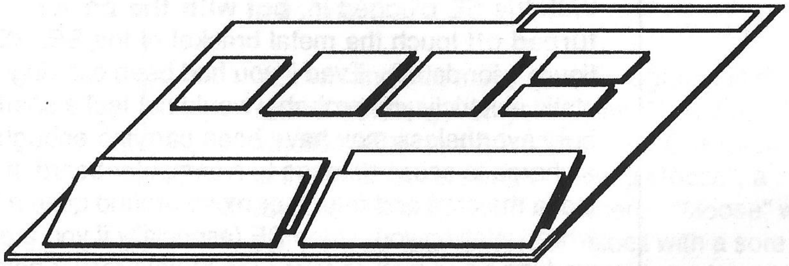
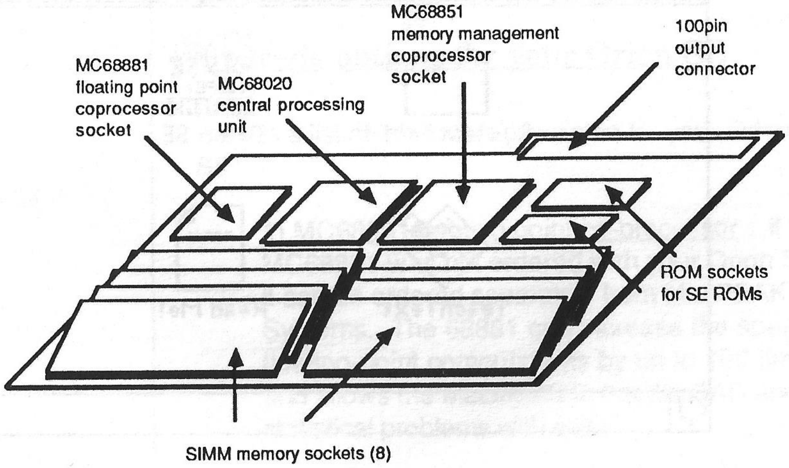


Figure 2 : The Orion SE logic board

What you should have received with the Orion SE

1) The Orion SE logic board (see figure 3 below for a listing of items on the Orion SE)



MC68851 memory management coprocessor socket
100pin output connector
MC68881 floating point coprocessor socket
MC68020 central processing unit
ROM sockets for SE ROMs
SIMM memory sockets (8)

Figure 3 : The processor, ROM, and expansion sockets on your Orion SE

2) Orion SE diskette and included software

The Orion SE package also includes the software needed to control the features of your Orion SE. All of the software functions available for your Orion SE can be found is a single file called "Orion SE" (see Figure 4). The section "Using your Orion SE" explains the use of the software.

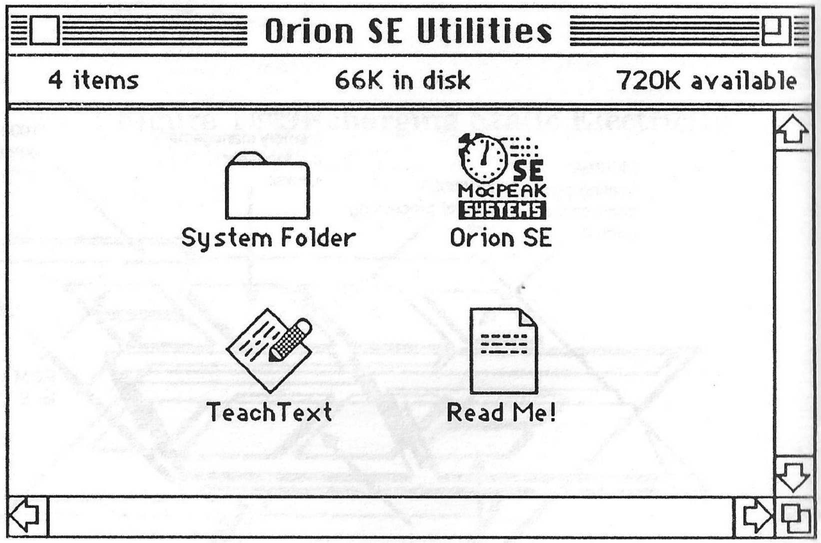


Figure 4 : The contents of your Orion SE diskette

3) Orion SE Installation and User's Manual

This manual.

4) Registration Card

This card should be filled out at this time and returned to MacPEAK. MacPEAK sends out update information and software in order to keep your Orion SE up to date with the latest developments in Macintosh hardware and software. Unless MacPEAK receives this card, you will not receive these mailings.

5) Warranty Card

This card explains the warranty coverage for your Orion SE . Also on the card is the information for what to do to receive warranty or non-warranty repair service.

Upgrade options for your Orion SE

Here is a list of the options available for your Orion SE:

1) MC68881 floating point co-processor : if the MC68881 was not ordered with your Orion SE, it can be ordered separately from MacPEAK Systems. The 68881 can increase the speed of floating-point computations by up to 100 times and allows the Macintosh to handle CAD and statistical problems with ease.

2) MC68851 memory management co-processor : the 68851 controls the use of memory in your Orion SE and will be a necessary option in the future to take full advantage of new operating system software from Apple.

3) Memory upgrades : with eight SIMM sockets available, your Orion SE is capable of supporting one, two, four, five or eight megabytes of high speed RAM. MacPEAK Systems can supply you with standard Apple SIMMs for upgrading your Orion SE equipped SE.

4) Galaxy™ large screen video : your Orion SE supports the MacPEAK Galaxy 19" large screen. This option gives you the capability to work with desktop publishing or other screen intensive software with ease as well as speed.

Preparing the Macintosh SE

As mentioned at the beginning of the manual, your Orion SE should be installed by a qualified Apple service center.

This section is written for a trained technician who is familiar with the Macintosh SE. The information in this section will be mostly a listing of the necessary actions to prepare the Macintosh SE for installation, not a step by step lesson of how to carry out these actions.

Steps for preparing the Mac SE for the Orion SE

1) Disconnect the power cord to the Macintosh SE.

2) Remove all peripherals connected to the Macintosh SE. This would include the mouse and keyboard cables, any external SCSI cables, any external floppy cables, and any devices connected to either the modem or printer ports.

3) Remove the programmer's switch from the rear left side of the SE if installed.

4) Remove the four screws from the Macintosh SE case

5) Set the Macintosh on it face with the bottom of the unit towards you. Be sure to place the face of the Macintosh on a soft towel or other item to keep from scratching the unit.

6) Remove the rear case cover from the SE.

7) Slide the main logic shield off the bottom of the SE.

8) Disconnect the internal SCSI cable (if the SE is equipped with an internal hard drive).

9) Disconnect the floppy diskette cable(s).

10) Disconnect the Power/Video cable from the SE main logic board.

11) Remove the SE main logic board from the SE chassis, disconnecting the sound connector before pulling the main logic board away. Place the main logic board on a clean open work service. Note: remember to handle with SE main logic board with caution regarding static electricity.

Preparing your Orion SE

This section deals with the actions necessary to prepare your Orion SE board before actually installing it into a Macintosh SE. Virtually all of this activity concerns setting up the memory of your Orion SE correctly.

Your Orion SE takes over all processing activity of the Macintosh and only the 32 bit memory installed on the Orion SE is used for normal memory. This means the Orion SE always operates at its maximum capability. The SE does need a small amount of memory on its main logic board to hold the information for the internal display and for the generation of sounds. For this reason, two 256K SIMMs remain on the SE's main logic board to handle sounds and the internal screen information while two of the 256K SIMMs can be removed from the SE main logic board. For Orions using either 1Mb or 2Mb of memory, the 256K SIMMs removed from the Mac SE main logic board can be used as part of the memory on your Orion SE. For users wishing a 4Mb or 8Mb Orion SE, the two 256K SIMMs would not be used on the your Orion SE, but could be removed from the Mac SE main logic board and used for some other purpose. Leaving these two 256K SIMMs on the Mac SE main logic board will not cause a problem but they will not by used as part of the computer's user memory.

One important fact about your Orion SE is it is a 32 bit computer. Just like the Macintosh II, this means it must deal with 32 bits of information at a time. One effect of this is the fact that unlike the SE (which is a 16 bit machine), your Orion SE must deal with groups of four SIMMs of the same type. It is not possible, for example, to install two 256K SIMMs and two 1mb SIMMs in your Orion SE (or the Mac II for that matter...) and work with the 2 1/2 megabytes as can be done on the SE. Your Orion SE must have one of the following memory configurations:

Memory configurations for the Orion SE

1Mb : four 256K SIMMs installed on your Orion SE

2Mb : eight 256K SIMMs installed on your Orion SE

4Mb : four 1mb SIMMs installed on your Orion SE

5Mb : four 1mb SIMMs and four 256K SIMMs installed on your Orion SE

8Mb : eight 1mb SIMMs installed on your Orion SE

Important Note for Macintosh SE owners who have upgraded the SE with 1mb SIMMs before installing the Orion SE:

As discussed in the opening section of the manual, your Orion SE (like the Macintosh II) is a 32 bit computer. One effect of this is the Orion SE must work with 32 bits of information at a time. Four SIMMs of the same type (ie: 256K or 1mb) are required to provide 32 bits at a time. For users who have purchased 2 1Mb SIMMs before purchasing the Orion SE there are two options for the 1Mb memory. Two more 1Mb SIMMs can be added allowing for a 4 or 5Mb Orion SE. The other option is to use the two 1Mb SIMMs as the memory in the Mac SE main logic board. While not the best use of 1Mb SIMMs it does allow for all four of the original 256K SIMMs from the Mac SE to be used on your Orion SE. Thus, a 1Mb configuration is available without the purchase of any additional memory. This would be a reasonable option until an additional two 1Mb SIMM could be purchased. If the 1Mb SIMMs are to be used for the Mac SE main logic memory skip ahead at this point to Appendix A, "Using 1Mb SIMMs on the SE main logic board. Follow the instructions in Appendix A and then continue with step 2 in this section.

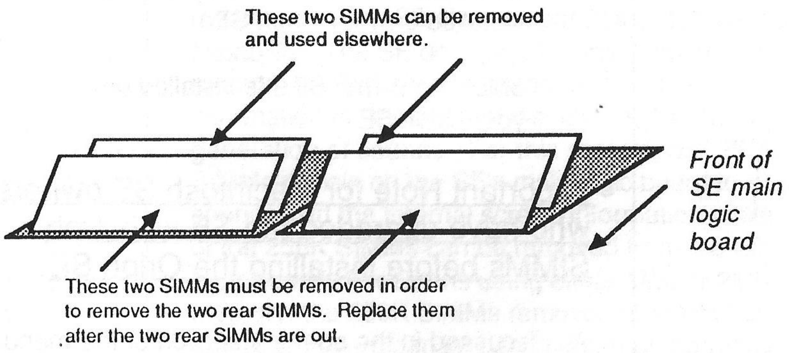

These two SIMMs can be removed and used elsewhere.
Front of SE main logic board
These two SIMMs must be removed in order to remove the two rear SIMMs. Replace them after the two rear SIMMs are out.

Figure 5 : Removing the SIMMS from the SE main logic board

The six steps for preparing your Orion SE

Step One : Removing two SIMMs from the SE main logic board

Place the Macintosh SE main logic board on a flat work area in front of you. In order to remove the correct two SIMMs from the SE board, you will need to remove all four of the SIMMs and then re-install two of them back onto the SE board. Figure 5 shows which SIMMs are to be removed from the SE card and which are to be re-installed.

Step Two : Installing the SIMMs from the SE main logic board onto the Orion SE

This step will be dependent on the total amount of memory to be installed on your Orion SE. On the following four pages are instructions for the different memory sizes possible. Look forward to the section that corresponds with the amount of memory you are setting the Orion SE to handle.

1Mb Orion SE :

Using the two 256K SIMMs removed from the SE main logic board and two additional 256K SIMMs install four 256K SIMMs into the sockets on your Orion SE as shown in figure 6. After completing this section, continue with step 3, "Removing the ROMs from the SE main logic board."

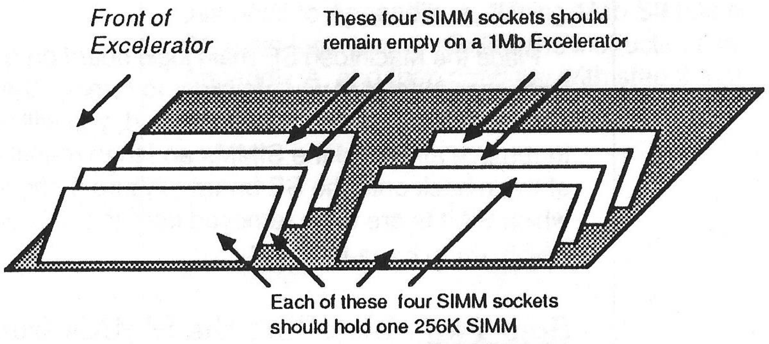

Front of Excelerator
These four SIMM sockets should remain empty on a 1Mb Excelerator
Each of these four SIMM sockets should hold one 256K SIMM

Figure 6 : Installing the 256K SIMMs onto a 1Mb Orion SE

2Mb Orion SE

Using the two 256K SIMMs removed from the SE main logic board and six additional 256K SIMMs install four 256K SIMMs into the sockets on your Orion SE as shown in figure 7.

This completes the installation of memory on the 2Mb Orion SE. After completing this section, continue with step 3, "Removing the ROMs from the SE main logic board."

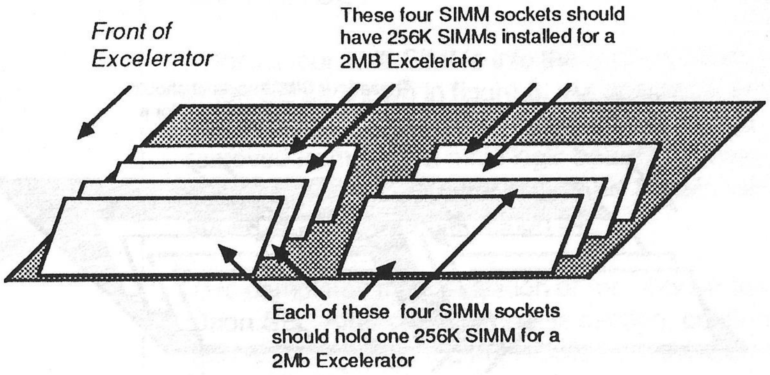

Front of Excelerator
These four SIMM sockets should have 256K SIMMs installed for a 2MB Excelerator
Each of these four SIMM sockets should hold one 256K SIMM for a 2Mb Excelerator

Figure 7: Installing the 256K SIMMs onto a 2Mb Orion SE

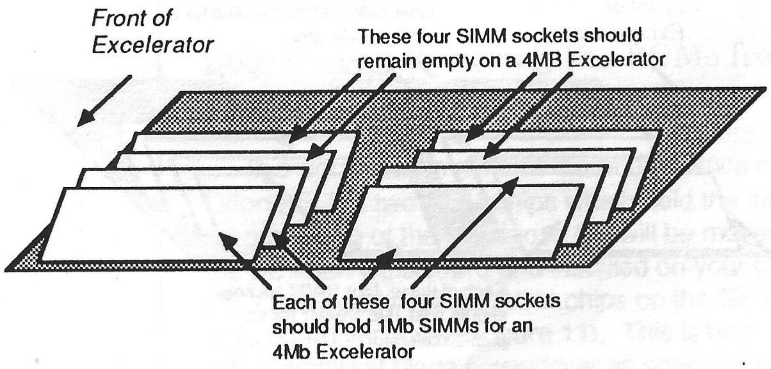

Front of Excelerator
These four SIMM sockets should remain empty on a 4MB Excelerator
Each of these four SIMM sockets should hold 1Mb SIMMs for an 4Mb Excelerator

Figure 8 : Installing the 1Mb SIMMs onto a 4Mb Orion SE

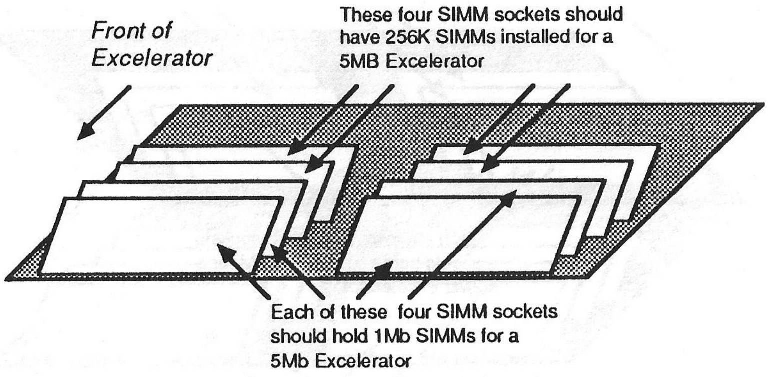

Front of Excelerator
These four SIMM sockets should have 256K SIMMs installed for a 5MB Excelerator
Each of these four SIMM sockets should hold 1Mb SIMMs for a 5Mb Excelerator

Figure 9 : Installing the 1Mb and 256K SIMMs onto a 5Mb Orion SE

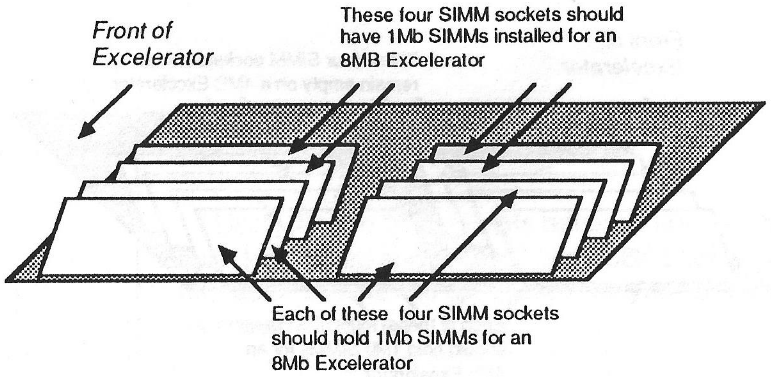

Front of Excelerator
These four SIMM sockets should have 1Mb SIMMs installed for an 8MB Excelerator
Each of these four SIMM sockets should hold 1Mb SIMMs for an 8Mb Excelerator

Figure 10 : Installing the 1Mb SIMMs onto a 8Mb Orion SE

4Mb Orion SE :

Install four 1Mb SIMMs into the sockets on your Orion SE as shown in figure 6. As described in step one on page 22, two of the 256K SIMMs can be removed from the SE main logic board and used in a different machine, or two more 256K SIMMs can be added to allow for a 5Mb Orion SE.

This completes the installation of memory on the 4Mb Orion SE. After completing this section, continue with step 3, "Removing the ROMs from the SE main logic board."

5 or 8Mb Orion SE :

The memory for the 5Mb and 8Mb Orion SE is the same as the 4Mb Orion SE, except the sockets closest to the processors will be filled with 256K SIMMs for the 5Mb version, and 1Mb SIMMs for the 8Mb version. See figures 9 and 10 respectively.

Step Three : Removing the ROMs from the SE main logic board

In order to help maximize the performance of your Orion SE, the two ROM chips which hold the internal programming of the Macintosh SE will be moved from the SE main logic board and installed on your Orion SE. (The location of the ROM chips on the SE main logic board is shown in figure 11). This is best done with a small flat blade screwdriver as shown in figure 12. Note when removing the chips that there is a small indention on the one end of each of the chips (see figure 13). The indentions show which end of the chip goes into the socket and helps to prevent plugging in the chips backwards. Please note the orientation of these indentions as the chips are installed into your Orion SE. The other item to note is the part numbers on the chips themselves. One of the chips is commonly refered to as "ROM High" and the other as "ROM Low". The matching part numbers for these two names are as follows:

ROM High : 342-0352
ROM Low : 342 -0353

Both the SE main logic board and your Orion SE board are have their sockets marked as "ROM Low" or "ROM High" to help identify which chip belongs to which socket. The ROM part numbers are also printed on the Orion SE board to guide in installing the ROM chips correcly.

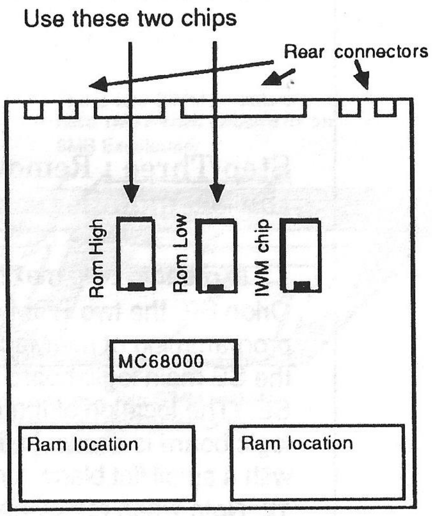


Figure 11 : Locating the ROMs on the SE main logic board

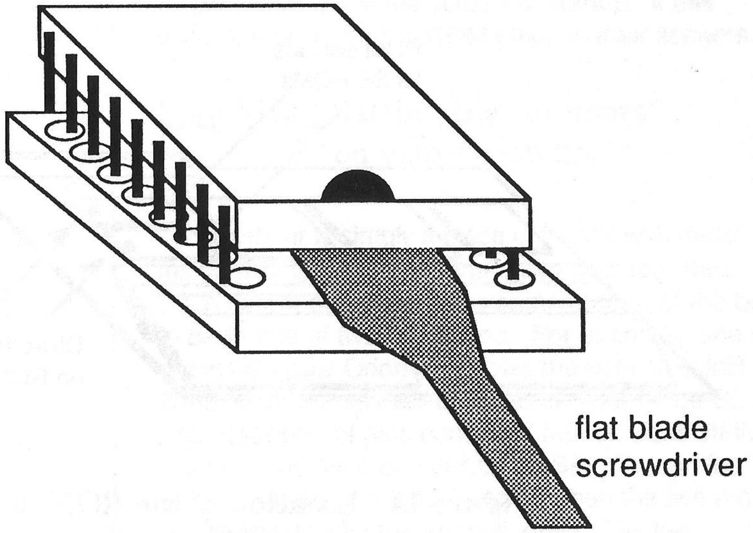


Figure 12 : Removing the ROMs from the SE main logic board

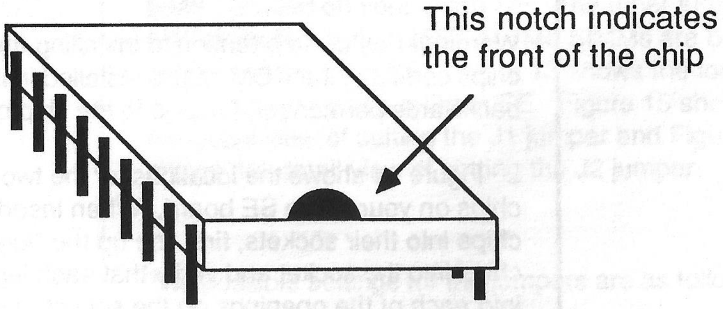


Figure 13 : The Direction Marker on the ROMs

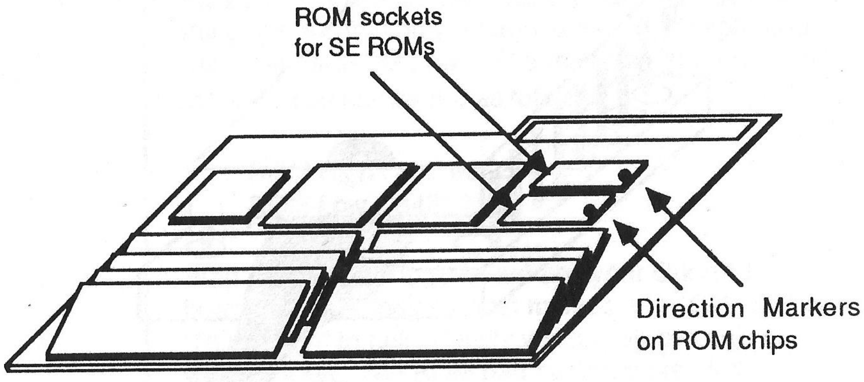


Figure 14 : Location of the ROM sockets on your Orion SE

Step Four : Installing the ROMs on your Orion SE

Warning! Pay close attention to installing the ROM chips correctly. If a ROM chip is installed in its socket backwards permanent damage to the chip can occur!

Figure 14 shows the locations for the two ROM chips on your Orion SE board. When inserting the chips into their sockets, first line up the "legs" of the chips into the socket and verify that each leg will fit into each of the openings on the socket. Gently press each ROM chip into its socket and then carefully visually inspect the chips and sockets to be certain none of the "legs" are bent or did not insert properly. Under no circumstances should the ROM chips be forced into the sockets. If you are encountering unusual friction in fitting the ROM chips into the socket, take a moment and look at the socket to identify the problem. Note : If the pins of one of the ROMs are bent, the Macintosh will show "bars" of black and white on the screen at startup. If this occurs, first check the ROM chips in their sockets.

Step Five : Setting the "jumpers" on your Orion SE

A jumper is simply a piece of plastic with metal inside that is used to connect two pins together. Each pair of pins can cause some feature of the board to be in one of two conditions. For example, one pair of pins on your Orion SE allows the user to select if 256K or 1Mb chips will be used on your Orion SE. The other pair of pins controls if four or eight SIMMs are to be installed on your Orion SE. These pins behave similar to a light switch. When the two pins are connected by the jumper, one of the two conditions will be true. By leaving the pins disconnected the feature will be in the other of the two settings.

There are two jumpers on your Orion SE, each controlling a different memory setting. One of the jumpers (J2) controls whether 4 or 8 SIMMs have been installed on your Orion SE. The other jumper (J1) controls whether 256K or 1Mb SIMMs are being used on your Orion SE. Figure 13 shows the location of the jumpers on your Orion SE. Figure 15 shows the detail view of setting the J1 jumper and Figure 16 shows the detail view of setting the J2 jumper.

The possible settings for the jumpers are as follows :

1Mb : J1 jumpered (256K SIMMs)
J2 jumpered (4 SIMMs)

2Mb : J1 jumpered (256K SIMMs)
J2 not jumpered (8 SIMMs)

4Mb : J1 not jumpered (1Mb SIMMs)
J2 jumpered (4 SIMMs)

5Mb and 8Mb : J1 not jumpered(1Mb SIMMs)
J2 not jumpered (8 SIMMs)

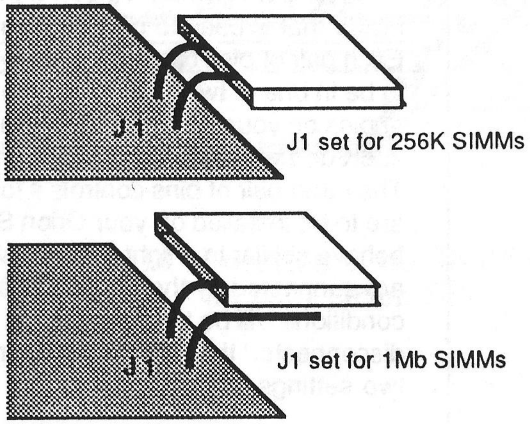


Figure 15 : Details of J1

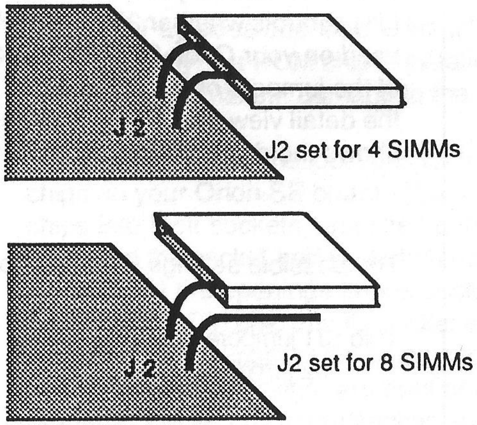


Figure 16 : Details of J2

Step Six : Placing your Orion SE board on the SE main logic board

At this point your Orion SE board is prepared and ready for installation on the Macintosh SE main logic board. Set the SE main logic board in front of you and pick up your Orion SE board. Using the shell of the 96 pin Euroconnector on your Orion SE , gently fit the male Euroconnector on your Orion SE onto the female Euroconnector on the Macintosh SE main logic board. Note : This operation should definitely not be a "force" motion. If the two connectors are showing more than token friction in connecting together, stop and look at what you are doing. Especially be sure that the male pins on your Orion SE are not being bent as a result of force. The two connectors are keyed and therefore can not be fully connected in an incorrect manner. your Orion SE connector should fit down virtually all the way onto the Mac SE's connector.

Next, gently snap the two white offsets on the side of the board opposite the Euroconnector into the the holes of the Mac SE's main logic board. This will require some pressure, but should be done with care.

The preparation of your Orion SE is now complete. Please go the next section, "Installing the Orion SE into the Macintosh SE".

Installing the Orion SE into the Macintosh SE

Note : You will find it much easier if you read this entire section before actually starting the installation. After reading through the section, return to this point and actually start the installation.

Check that everything is ready

At this point in the installation, your Orion SE should be secured onto the top of the Mac SE main logic board, the SE chassis should be on its face (with a soft towel or other protection under the SE to prevent scratching), and all memory and jumpers should be installed on your Orion SE. If there are any doubts about the setup, please review the previous section, "Preparing your Orion SE". Position the Mac SE chassis so that the bottom is facing towards you. There should be a two wire cable coming out of the bottom of the chassis, but all other cables should be positioned in the middle cavity of the chassis in order to connected later.

Position front of Mac SE/Orion SE board into botom front of the Mac SE chassis

First, pick up the Macintosh SE/Orion SE board combo, and fit the front of the Mac SE main logic board into the bottom front of the Mac SE chassis (see figure 17). Use a 45° angle when inserting the boards. There will be some tabs in the front inside bottom of the SE case that are used as guides for the SE main logic board. See figure 18 for detail of how the tabs and the board should be positioned. Only the Mac SE board will be contacting the chassis; your Orion SE board is set back so that it doesn't contact the chassis.

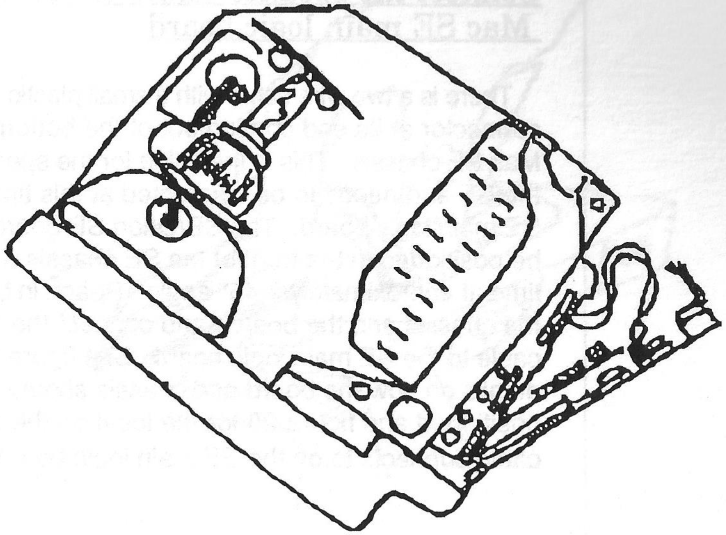


Figure 17 : Positioning the Mac SE/Orion SE into the Mac SE chassis

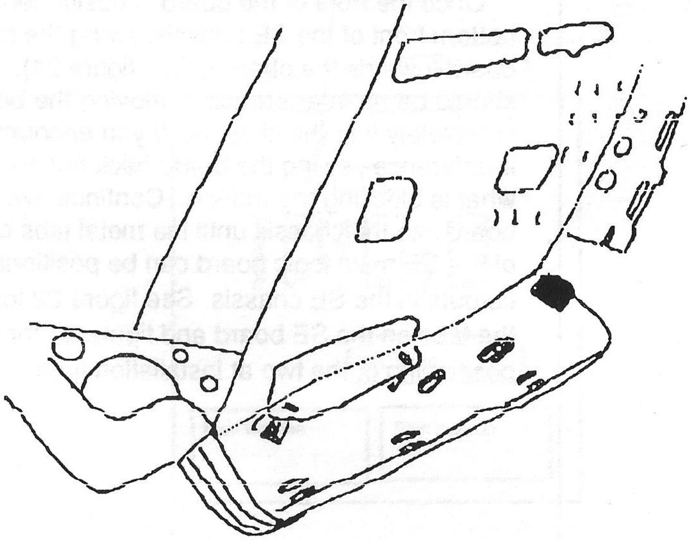


Figure 18 : Detail view of the tabs in the bottom front of the Mac SE chassis

Connect the speaker connector to the Mac SE main logic board

There is a two wire cable with a small plastic connector at its end coming out of the bottom of the Mac SE chassis. This is the cable for the speaker in the SE and needs to be connected at this time to the SE main logic board. The SE/Orion SE board should be positioned in the front of the SE chassis at this time at approximately a 45° angle. Reach in between the chassis and the boards and connect the sound cable to the SE main logic board. See figure 19 for details on how the board and chassis should be positioned and figure 20 for the location the sound cable connects to on the SE main logic board.

Swing the back of the Mac SE/Orion SE board combo into the chassis

Once the front of the board is positioned into the bottom front of the SE chassis, swing the rear of the board towards the chassis (see figure 21). There should be no interference in moving the board completely into the chassis. If you encountered any interference , swing the board back out and look at what is blocking the motion. Continue swinging the board into the chassis until the metal tabs on the back of the SE main logic board can be positioned into the cutouts in the SE chassis. See figure 22 for detail of the tabs on the SE board and figure 23 for the positioning of the two at installation time.

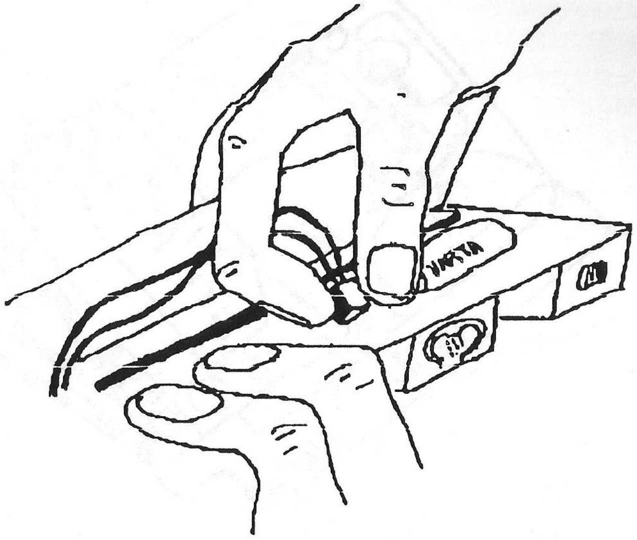


Figure 19 : Position of boards/chassis when connecting sound cable

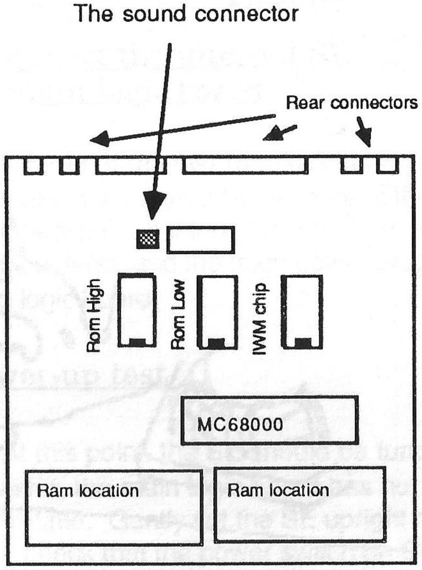


Figure 20 : Location of the sound connector on the SE main logic board

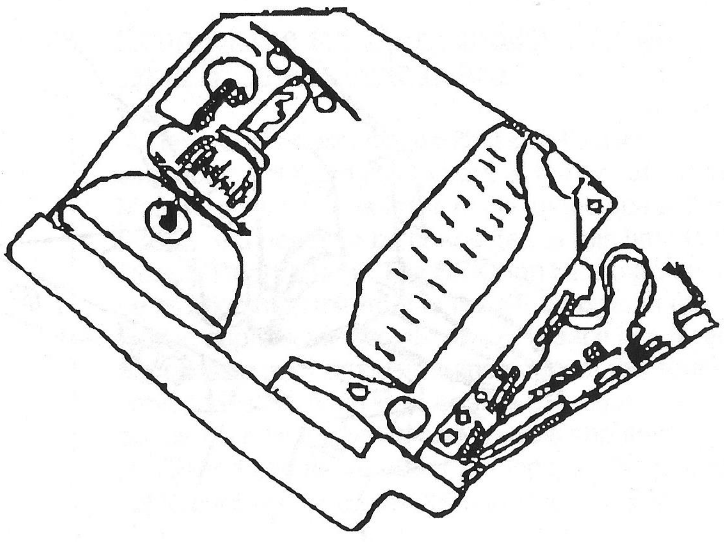


Figure 21 : Swinging the boards into the chassis

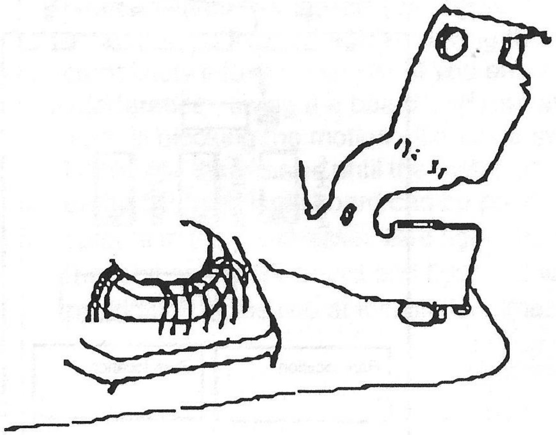


Figure 22 : Detail of metal tabs on the SE main logic board

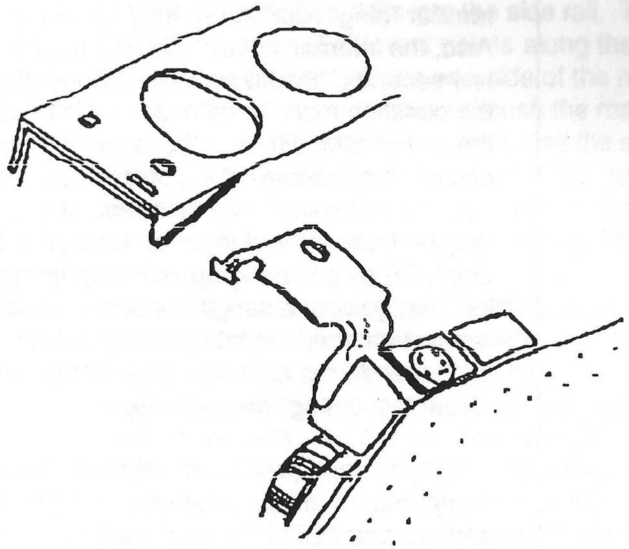


Figure 23 : Detail of inserting the SE board tabs into the SE chassis

Reconnect the internal SE cables to the SE main logic board

In reverse manner from disconnecting them, reconnect the internal SCSI cable (if the SE is equipped with an internal hard drive), the diskette drive cable(s), and the main power plug into the SE main logic board.

Power-up test

At this point, the SE should be functional; however, the main logic board has not been secured at this time. Gently set the SE upright on its base. First, check that the power switch on SE has the 0 pushed in towards the machine (this indicates the power is off). Connect the AC power cord to the SE and position the machine so that the power switch can conveniently be reached, and the screen can be seen. You will be looking for two things after powering the SE on. First, you should hear the familiar "bing" sound from the Macintosh at power on. Also, the internal screen should turn gray, and after a few seconds, should show the floppy disk icon with the question mark in the middle. Note : Simply turn the power off if either of these two things do not occur. This indicates that something about the inital setup of installation was incorrect, or your Orion SE may be faulty. The danger of damage to the SE or Orion SE by powering up with something installed incorrectly is not a danger. It simply means that the installation needs to be double checked. If either of the items do not occur proceed to the section "Troubleshooting" on page 49.

At this time, power on the SE and check for the "bing" and the gray screen/floppy drive icon. If they appear, proceed to the next section. Otherwise, look ahead to "Troubleshooting" on page 49.

Note : the amount of memory in the SE affects how long it takes for the floppy disk icon to appear (the SE is doing a memory test during this time). If you have upgraded the memory of the SE at the same time of installing the Orion, the SE will take longer to complete this activity.

Completing the installation

After the power-up test has been successfully completed, the main logic should be secured into the Macintosh SE chassis. First, power off the Macintosh and disconnect the power and any other cables that may have been connected. Place the Macintosh on its face (with a towel or other protection to prevent scratches). The bottom of the Macintosh should be facing you. The SE main logic board is designed to fit in two side rails of the SE's metal chassis. Currently, the SE main logic board is in place in the bottom of the SE, but the sides of the main logic board should not be fitted into the chassis rails. Carefully insert a flat blade screwdriver between the main logic board and the side rail. Use the screwdriver to push the rail slightly to the side so that the main logic board can be worked further into the Macintosh and the side edge of the main logic board fits into the side rail. This will need to be done at different points along the side of the main logic board. Once one side of the main logic board is fitted into its chassis rail push the main logic as far into that rail as it will go. Next, use the same method with the flat blade screwdriver on the other side of the main logic board. You should find that the second side is a slightly easier fit than the first side.

Once the main logic board is firmly back in place in the SE's chassis, replace the foil shield around the bottom and back of the main logic board. Replace the rear case piece and re-install the four screws in the back of the case. Set the machine upright and give it another power up test. If everything appears fine the installation is complete. If you encounter any problems, go to the section "Troubleshooting" on page 49.

Using your Orion SE

For the most part, using your Orion SE equipped Macintosh SE is exactly like using a normal Macintosh. For a thorough discussion about software compatibitiy and your Orion SE , look at the section of the manual entitled "Why is your Orion SE more compatible than the Macintosh II" and also "Sound programs and your Orion SE " starting on pages 8 and 11.

Important Note: The control software for the Orion SE can be completely bypassed at startup time by simply holding the shift key during the startup of the Macintosh. By holding down the shift key from the "bing" until the Finder is running, all pre-set values for processor and memory speed are overridden. In this circumstance, the Orion SE will be operating at 16Mhz and expecting memory as slow as 150ns. If any problems are encountered while operating the Orion SE it is suggested that the Macintosh be started up with the software disabled and verify if the problem still occurs.

The Orion SE Control Software

The control software can be found on the diskette included with your Orion SE board. There is a single file, called "Orion SE" which handles all the software functions necessary.

Installing the Orion SE Control Software

To install the control software, simply copy the "Orion SE" file from the diskette to the System Folder on any of the startup volumes you use for your Macintosh. If you have a hard disk, place a copy of the file in the hard disk's System Folder. If you start you Macintosh with different diskettes place a copy of "Orion SE" in each diskette's System Folder also. After you have copied the file to the appropriate System Folder, restarting the machine will cause the software to be fully functional.

Using your Orion SE Control Software

There are a number of areas your Orion SE control software handles. Here is a list of those areas and how the control software works for each area.

1) MC68020 processor speed : The speed of the processors on your Orion SE is changable, even during machine operation. Normally, a user would want the processor to go at its maximum speed in order to get the highest performance from the machine. However, there can be times that running the machine at a slower pace is useful. Your Orion SE is capable of going at the different following speeds:

Maximum speed: This will either be 20Mhz or 25Mhz depending on which version of the board you have. This will be the normal operating speed of the board most of the time.

16Mhz: All of your Orion SE boards are capable of running at 16Mhz, the same speed as the Macintosh II and IIx.

"Standard SE speed" : This is a speed setting that has the same effect as turning your Orion SE accelerator off. Virtually any software program that is having a problem working with the accelerator at 16Mhz or faster should work correctly when this setting is used.

2) MC68881 processor speed : The MC68881 floating point co-processor chip's speed can also be set by your Orion SE control software. This would be used simply to set your Orion SE to run the '881 at the highest speed it is capable of running. There will be no compatiblity advantages to running the '881 chip at a slower speed.

Warning: the software will allow a 16Mhz MC68881 to be run at 20Mhz or 25Mhz (depending on the speed of the '020 used). It is not advised to run a 16Mhz MC68881 chip at a higher clock speed than 16Mhz. Doing so should not cause physically damage to the chip, but the results can be unpredictable, resulting in the computer incorreclty computing mathmatical operations and other causing the computer to simply "lock up".

3) Memory speed : The speed of the memory installed has an important effect on the performance of your Orion SE. Your Orion SE has the unique capability of being able to use faster memory as it is installed. A normal Macintosh SE, II, or IIx will only run memory at a set speed (120ns) and even though faster memory could be installed (100ns, 85ns, 60ns) the Macintosh would not perform with any increase in speed.

The memory speed that is used on your Orion SE must be matched to the slowest memory installed on the board. On a two megabyte Orion SE, seven of the eight memory SIMMs could be 85ns speed parts, but if the eighth SIMM is a 120ns part, the memory speed should be set for the 120ns speed.

Memory speeds available based on processor speed

20Mhz :

150ns
120ns
100ns
85ns

Note : on a 20Mhz machine with 85ns memory the processor no longer encounters any delays in reading or writing from memory. Installing 60ns memory will not increase the speed of the machine.

25Mhz :

120ns
100ns
85ns
60ns

Note : on a 25Mhz machine 150ns memory is not a usable setting. 120ns memory is the slowest that can be installed on a 25Mhz Orion SE.

4) MC68020 Instruction Cache

One of the features of MC68020 processor chip is an internal area of the chip that stores the most recent 256 bytes of instructions that the processor executed. The reason this is done is the allow the processor to check if a loop of instructions is being executed that is smaller than the 256 bytes the processor can store. If such a loop of instructions is occuring (and this is a fairly common event), the processor will simply reuse these instructions it has stored internally and avoid any delays involved in re-reading the instructions from their original memory locations. Due to the vast difference in speed between internally re-using the instructions and re-reading them from memory, the MC68020 is capable of large performance gains on tight loops.

Your Orion SE control software is capable of turning this instruction cache feature off. This would only be done if some software was having a compability problem and the instruction cache was the cause of the problem. This situation can occur on software that has timing loops that are executed a preset number of times in order to create a delay. Since the instruction cache will greatly speed up such loops, the timing will not be what was originally expected by the software and this can cause some problems. This situation is a rare one, and there is no known software that is currently commercially shipping that has problems due to this situation.

5) SANE881 controls

The MC68881 chip can dramatically speed up math operations, but most commercial software does not have the capability to automatically go out and use the MC68881 if it is present. Virtually all Macintosh software uses what is known as "SANE" (Standard Apple Numerics Environment) to perform math operations that involve floating-poing numbers. SANE is a standard library of floating point math routines that was designed for application software to take advantage of.

The job that MacPEAK's SANE881 software must perform is to look like the normal SANE software to the application and yet take advantage of the hardware floating point capability of the MC68881. It does this by "intercepting" any software request made by an application program to the SANE library of math routines. Instead of letting the SANE software routines complete the calculation, SANE881 takes the information intended for SANE (ie: the numbers to work on and the operation, such as multiply, divide, etc...) and uses the '881 to calculate the answer. After the '881 has the answer, SANE881 will take that answer and return it to the application in the exact same way that the SANE software routine would have. As far as the application is concerned, SANE software routines did all the work, albeit around 50 times faster than normal.

By using the Orion SE control software, SANE881 can be enabled or disabled. If it is enabled, whenever an application tries to use the SANE floating-point software library to perform a floating-point calculation, the SANE881 software will re-direct the calculation of the math operation to the MC68881, resulting in a 50 to 100 times speed increase on that calculation. If SANE881 is disabled, the software SANE routines will be used to do the calculations in the exact same way it was handled before your Orion SE was installed.

There are commercial programs that have been programmed to go directly to the MC68881 math chip if it is present and avoid all the overhead involved in the "pretend SANE is doing the calculation" arrangement. Microsoft Excel is a good example of such a program. It will tell you at start-up that an MC68881 has been detected and will be used directly. By going direct to the MC68881 speed increases are even more dramatic than when SANE881 is used. For software that directly access the MC68881, the only way to disable the use of the MC68881 is to remove the chip, forcing the program to use SANE instead. (There is not any good reason to disable the MC68881 from receiving direct calls.)

6) RomCache

When your Orion SE was installed in the Macintosh SE, the ROM (read-only memory) chips were transferred from their normal locations on the SE main logic board to your Orion SE's main logic board. This is done to increase the speed of the machine, since your Orion SE is capable of reading the information from the ROM chips directly faster than if it had to go down to the SE's main logic board to do the same read operation. However, even when the ROMs are on your Orion SE there is a delay when it reads the routines in the ROMs due to the access time required by the ROM chip itself. This delay can be overcome by copying the software in the ROMs to the high-speed main memory on your Orion SE itself. This will cause approximately a 15% speed increase with most applications. The trade-off of this operation is the fact that 256K of main memory will be used for storing the ROM routines that would otherwise be avaiable for the application's use. This capability is refered to as "romCache" and can be turned on or off with the Orion SE software. The control can be changed during normal operation of the Macintosh, but the change will not ocur until the machine is restarted. (It is during the startup of the computer that the ROM routines are copied into the main memory. Once they are there, they will stay there until the machine is restarted.) RomCache is known to cause various software problems on a small percentage of existing software, so if problems are encountered with a given package, first see if RomCache is on and

if it is, turn it off, restart the machine, and try the software again.

Note: It is not advised to use RomCache on a 1Mb Macintosh since 256K of memory will be unavailable. Many commercial programs expect a minimum of 1Mb of main memory to be available.

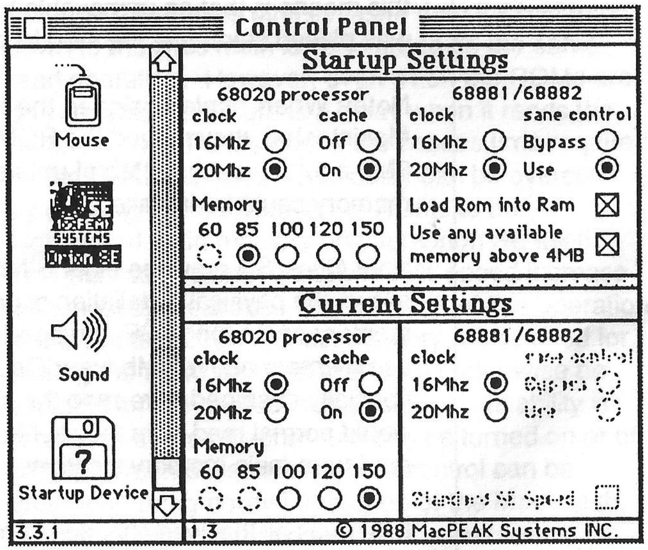
7) Use memory above 4Mb

Your Orion SE has the unique cability of allowing more than 4Mb of main memory to be used on the Macintosh SE. The reason that there is a 4Mb limit on the SE is fairly straighforward. When the 128K Macintosh was designed the most memory that personal computers of the time were able to use was around 512K. Therefore, when the designers decided to where in the memory map to place to ROM routines that would handle the Macintosh's user interface, 4Mb of main memory seemed and almost unreachable amount for a personal computer. What this means is that an unmovable block of instructions was placed starting at the 4Mb location.

Note : When Apple designed the ROMs for the Macintosh II, they moved the ROM routines to the 8Mb address so that 8Mb of uninterrupted main memory could be installed.

Your Orion SE provides eight SIMM sockets, which allows the physical installation of up to 8Mb of main memory on an Orion SE equipped SE. In order to use memory above 4Mb, your Orion SE has been specially designed to re-map the addresses that would normal read from the ROM chips to instead read from main memory locations.

If this was all that was changed, a major problem would then occur. Whenever the Macintosh would need to use the instructions in the ROMs to create the user interface (ie: the windows, menus, dialogs, etc..) it would call the ROM memory locations at their normally accessed addresses only to find empty main memory instead. In order to avoid this problem, the ROM contents are copied into the same main memory addresses that they have in the ROM. Thus, an access to a normal Macintosh ROM address will have the same effect on an Orion SE with 5Mb or 8Mb of main memory as it would on a 4Mb or less SE. This is the same technique as RomCache which is discussed in section six above, with the same advantages and disadvantages RomCache encounters. The "Use memory above 4Mb" option allows the memory above 4Mb to be seen as main memory, and also causes the automatic copying of the ROM contents into the 4Mb address space in main memory as they are located in the ROMs. If the option is not selected, the Orion SE equipped SE will simply not use or see any memory that may be installed above the normal 4Mb limit. Like RomCache this is a startup-time operation. When the control is changed, the effect will not occur until the Macintosh is restarted.



Startup Settings

68020 processor
clock: 16Mhz ○ 20Mhz ●
cache: Off ○ On ●
Memory: 60 ○ 85 ● 100 ○ 120 ○ 150 ○

68881/68882
clock: 16Mhz ○ 20Mhz ●
sane control: Bypass ○ Use ●
Load Rom into Ram ☒
Use any available memory above 4MB ☒

Current Settings

68020 processor
clock: 16Mhz ● 20Mhz ○
cache: Off ○ On ●
Memory: 60 ○ 85 ○ 100 ○ 120 ○ 150 ●

68881/68882
clock: 16Mhz ● 20Mhz ○
sane control: Bypass ○ Use ○
Standard SE Speed ☐

1.3 © 1988 MacPEAK Systems INC.

Troubleshooting the Orion SE

This section is designed to help diagnose any problems that could be encountered in installing or using your Orion SE. If you do not see the answer to the problem you are dealing with, please contact MacPEAK Technical Support Dept. @ 1-512-327-3211.

Vertical or horizontal "bars" on the screen:

This indicates that the Orion SE is not starting up properly. Check the following in the order listed.

1) Check that the ROM chips have been inserted correctly.
a) each ROM in correct socket (High vs Low).
b) all the pins on each of the ROMs have been inserted in the ROM sockets with no bends.
c) the ROMs are not installed backwards (ie: the small notch on each ROM matches the notch in the ROM socket). Note : if either of the ROMs have been installed backwards, permanent damage to the ROM may have occured. If either ROM was installed backwards, and your Orion SE still does not work correctly after the ROMs have been re-installed, remove the Orion SE from the SE and use the ROMs in the SE to verify their function.
Information about installing the ROMs starts on page 26.

2) Check the memory jumpers (J1 & J2) for proper settings. See page 30 for review.

3) Check the SIMMs and the SIMM sockets. If all memory has been installed correctly, try removing and re-installing the SIMMs to enusre the memory is getting good contact in the sockets. (For info about the proper SIMM setup, start at page 22).

4) Remove the Galaxy video adapter if it is installed.

5) Verify that your Orion SE is firmly seated on the SE main logic board connector.

If all of these areas check out, call MacPEAK technical support for more assistance.

The fan comes on, but nothing appears on the screen and the "bing" does not occur.

Check if the internal power cable is plugged all the way into the SE main logic board connector.

The floppy disk icon with the question mark appears, but the Mac doesn't respond when a diskette is put in.

Check if the diskette drive cable(s) is/are plugged in all the way into their sockets.

The floppy disk icon appears, but the internal hard drive does not work.

Check that the internal SCSI cable is connected properly.

On a dual floppy drive SE, when two disks are inserted and the Mac is turned on, the SE starts up from the top drive insted of the normal bottom drive.

Reverse the diskette drive cables on the SE main logic board.

The SE seems to run out of memory quickly.

Check if the "RomCache" option is turned on in the Orion SE control panel. If it is, and the SE has 1Mb of memory, turn off "RomCache" and restart the machine.

Floating point operations are not occuring any faster than on a normal SE.

First, check that the Orion SE control software is in the System Folder. If not, copy it into the system folder of the SE's startup volume from your Orion SE utility diskette.

Second, use the control software to check if the "Use the 881" setting is turned on, both for startup and current.

Appendix A : Using 1Mb Simms in the SE main logic board

Note : This section is for users who have previously upgraded their Mac SE to 2 1/2 Mb of RAM memory. By following these instructions in place of the normal instructions, it is possible to use two 1Mb SIMMs as the necessary memory on the SE main logic board. As mentioned in the main text, this is only advised if the SE being used has been upgraded previously to a 2 1/2 Mb machine and the Orion SE is to be equiped with either 1Mb or 2Mb of 256K SIMMs. If the SE being used has not been upgraded to 2 1/2 Mb before this installation, please read look at the section of the manual starting on page 32. Otherwise, continue with these instructions.

Place the Macintosh SE main logic board on a flat work area in front of you. Remove the two frontmost SIMMs from the SE main logic board. These should be 256K SIMMs. This leaves the two 1Mb SIMMs in the rearmost SIMMs (ie: closest to the rear connectors). Figure A3 shows which SIMMs are to be removed from the SE card and which are to be re-installed.

When the 1Mb Simms were originally added to the SE, a resistor in the "Ram Size" box on the SE main logic was clipped. This resistor should remain clipped. In order to use 2 1Mb Simms on the SE main logic, a 150Ω resistor should be added to the "1 Row" location (this is just below the previously clipped resistor.) Note: this requires soldering the resistor into the SE main logic board. This should only be performed by a certified Apple technician.

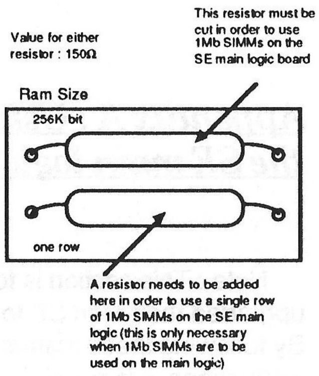

Value for either resistor : 150Ω
This resistor must be cut in order to use 1Mb SIMMs on the SE main logic board
Ram Size
256K bit
one row
A resistor needs to be added here in order to use a single row of 1Mb SIMMs on the SE main logic (this is only necessary when 1Mb SIMMs are to be used on the main logic)

Figure A1 : The Ram Size box on the SE main logic board.

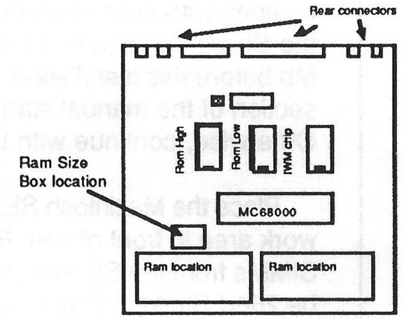


Figure A2 : The location on the SE main logic of the Ram Size Box

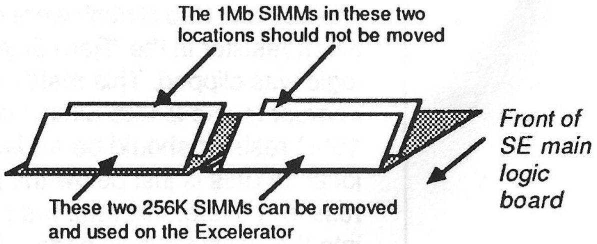

The 1Mb SIMMs in these two locations should not be moved
These two 256K SIMMs can be removed and used on the Excelerator
Front of SE main logic board

Figure A3 : The memory configuration with 1Mb SIMM on the SE main logic

A MacPEAK Systems product.

Orion SE and Galaxy are trademarks of MacPEAK Systems. Other brand or product names are trademarks or registered trademarks of their respective companies.